Supplementary data 2. Elementary reactions involved in the microkinetic modelling. * and _g denote surface and gas-phase species, respectively.

#	Reaction	Expression
1	1.0-1.1	*_s + CH4_g <-> H-CH3* -> H* + CH3_g
2	1.0-1.2	*_s + H2_g <-> H-H* -> H2*
3	1.0-2.3a	*_s + CH3_g -> CH3*
4	1.0-2.4a	*_s + CH4_g <-> C-H4* -> HCH3*
5	1.0-2.4b	*_s + CH4_g <-> CH-H3* -> CH3H*
6	1.0-3.2	*_s + C2H2_g -> CHCH*
7	1.0-3.4c	*_s + C2H4_g -> H2CCH2*
8	1.1-1.2	H* + CH4_g <-> H2-CH3* -> H2* + CH3_g
9	1.1-3.3b	H* + C2H2_g -> CHCHH*
10	1.1-2.4a	H* + CH3_g -> HCH3*
11	1.1-2.4b	H* + CH3_g -> CH3H*
12	1.1-2.5a	H* + CH4_g <-> H-CH4* -> CH3H2*
13	1.1-3.5i	H* + C2H4_g -> H2CCH2H*
14	1.2-1.3a	H2* + CH4_g <-> H2H-CH3* -> H2H* + CH3_g
15	1.2-1.3b	H2* + CH4_g <-> HH2-CH3* -> HH2* + CH3_g
16	1.2-2.5a	H2* + CH3_g -> CH3H2*
17	1.2-2.5b	H2* + CH3_g -> CH2H3*
18	1.2-2.6	H2* + CH4_g <-> H2-CH4* -> CH3H3*
19	1.2-3.4a	H2* + C2H2_g -> C2H2H2*
20	1.2-3.4b	H2* + C2H2_g -> H2C2H2*
21	1.2-3.6a	H2* + C2H4_g -> H2C2H4*
22	1.2-3.6b	H2* + C2H4_g -> C2H4H2*
23	1.3a-3.5c	H2H* + C2H2_g -> C2H2H3*
24	1.3a-3.7a	H2H* + C2H4_g -> C2H4H3*
25	1.3b-3.5d	HH2* + C2H2_g -> CH3HCH*
26	1.3b-3.7b	HH2* + C2H4_g -> CH3H2CH2*
27	2.0-2.1	C* + CH4_g <-> CH-CH3* -> CH* + CH3_g
28	2.0-2.2c	C* + H2_g <-> H-CH* -> H2C*
29	2.0-2.2d	C* + H2_g <-> CH-H* -> CHH*
30	2.1-2.2c	CH* + CH4_g <-> CH2-CH3* -> H2C* + CH3_g
31	2.1-2.2d	CH* + CH4_g <-> CH3-CH2* -> CHH* + CH3_g
32	2.1-2.3e	CH* + H2_g <-> CH-H2* -> CHH2*
33	2.1-2.3f	CH* + H2_g <-> CH-H-H* -> CHHH*
34	2.2a-2.2b	CH2* <-> C-H-H* -> HCH*
35	2.2a-2.3a	CH2* + CH4_g <-> CH3-CH3* -> CH3* + CH3_g
36	2.2a-2.3b	CH2* + CH4_g <-> CH3-HCH2* -> HCH2* + CH3_g
37	2.2a-3.5a	CH2* + CH3_g -> CH3CH2*
38	2.2a-3.5g	CH2* + CH3_g -> CHHCH3*
39	2.2b-2.2c	HCH* <-> H-C-H* -> H2C*

40	2.2b-2.3c	HCH* + CH4_g <-> CH2H-CH3* -> CH2H* + CH3_g
41	2.2b-2.3d	HCH* + CH4_g <-> CH3-H2CH* -> H2CH* + CH3_g
42	2.2b-3.5c	HCH* + CH3_g -> C2H2H3*
43	2.2b-3.5d	HCH* + CH3_g -> CH3HCH*
44	2.2c-2.2d	H2C* <-> HC-H* -> CHH*
45	2.2c-2.3e	H2C* + CH4_g <-> CH2-HCH3* -> CHH2* + CH3_g
46	2.2c-2.3f	H2C* + CH4_g <-> HCH-HCH3* -> CHHH* + CH3_g
47	2.2c-3.5h	H2C* + CH3_g -> H2CCH3*
48	2.2c-2.4b	H2C* + H2_g <-> CH2-H2* -> CH3H*
49	2.2d-2.3f	CHH* + CH4_g <-> HCH-H2CH2* -> CHHH* + CH3_g
50	2.3a-2.3b	CH3* <-> CH2-H* -> HCH2*
51	2.3a-2.4a	CH3* + CH4_g <-> CH3-HCH3* -> HCH3* + CH3_g
52	2.3b-2.3c	HCH2* <-> H-CH2* -> CH2H*
53	2.3b-2.4a	HCH2* + CH4_g <-> HCH3-CH3* -> HCH3* + CH3_g
54	2.3c-2.3d	CH2H* <-> HC-H-H* -> H2CH*
55	2.3c-3.6d	CH2H* + CH3_g -> C2H3H3*
56	2.3d-3.6c	H2CH* + CH3_g -> CH3HCH2*
57	2.3e-2.3f	CHH2* <-> HC-H2* -> CHHH*
58	2.3e-2.4b	CHH2* + CH4_g <-> HCH2-CH4* -> CH3H* + CH3_g
59	2.3f-2.4b	CHHH* + CH4_g <-> CH3-CH4* -> CH3H* + CH3_g
60	2.3f-3.6e	CHHH* + CH3_g -> H2CCH3H*
61	2.3f-2.5a	CHHH* + H2_g <-> CH3-H2* -> CH3H2*
62	2.4b-2.5a	CH3H* + CH4_g <-> H2CH3-CH3* -> CH3H2* + CH3_g
63	2.5a-2.5b	CH3H2* <-> CH2-H-H2* -> CH2H3*
64	2.5a-2.6	CH3H2* + CH4_g <-> CH3H3-CH3* -> CH3H3* + CH3_g
65	2.5a-3.8b	CH3H2* + CH3_g -> CH3H2CH3*
66	2.5b-2.6	CH2H3* + CH4_g <-> CH3-CH3H3* -> CH3H3* + CH3_g
67	2.5b-3.8a	CH2H3* + CH3_g -> C2H5H3*
68	3.2-3.3a	CHCH* + CH4_g <-> C2H3-CH3* -> CHCH2* + CH3_g
69	3.2-3.3b	CHCH* + CH4_g <-> HC2H2-CH3* -> CHCHH* + CH3_g
70	3.2-3.4a	CHCH* + H2_g <-> C2H2-H2* -> C2H2H2*
71	3.3a-3.4c	CHCH2* + CH4_g <-> HC2H3-CH3* -> H2CCH2* + CH3_g
72	3.3a-3.4d	CHCH2* + CH4_g <-> H2C2H2-CH3* -> HCCH2H* + CH3_g
73	3.3a-3.5f	CHCH2* + H2_g <-> C2H3-H2* -> C2H3H2*
74	3.3b-3.4a	CHCHH* + CH4_g <-> H3C2H-CH3* -> C2H2H2* + CH3_g
75	3.3b-3.4d	CHCHH* + CH4_g <-> C2H4-CH3* -> HCCH2H* + CH3_g
76	3.4a-3.5c	C2H2H2* + CH4_g <-> C2H2H3-CH3* -> C2H2H3* + CH3_g
77	3.4a-3.5f	C2H2H2* + CH4_g <-> C2H3H2-CH3* -> C2H3H2* + CH3_g
78	3.4b-3.5d	H2C2H2* + CH4_g <-> C2H5-CH3* -> CH3HCH* + CH3_g
79	3.4b-3.5e	H2C2H2* + CH4_g <-> HC2H4-CH3* -> H2C2H3* + CH3_g
80	3.4c-3.5h	H2CCH2* + CH4_g <-> H2C2H3-CH3* -> H2CCH3* + CH3_g
81	3.4c-3.5i	H2CCH2* + CH4_g <-> H3C2H2-CH3* -> H2CCH2H* + CH3_g
82	3.4d-3.5i	HCCH2H* + CH4_g <-> H4C2H-CH3* -> H2CCH2H* + CH3_g
83	3.4d-3.5h	HCCH2H* + CH4_g <-> H5C2-CH3* -> H2CCH3* + CH3_g

84	3.5a-3.6c	CH3CH2* + CH4_g <-> CH3-CH3HCH2* -> CH3HCH2* + CH3_g
85	3.5a-3.5d	CH3CH2* <-> CH3-H-CH* -> CH3HCH*
86	3.5b-3.5c	CH2CH3* <-> CH-H-CH3* -> C2H2H3*
87	3.5b-3.5g	CH2CH3* <-> C-H2CH3* -> CHHCH3*
88	3.5b-3.5f	CH2CH3* <-> CH2-H-H2C* -> C2H3H2*
89	3.5b-3.6d	CH2CH3* + CH4_g <-> CH3-C2H3H3* -> C2H3H3* + CH3_g
90	3.5c-3.6d	C2H2H3* + CH4_g <-> C2H3H3-CH3* -> C2H3H3* + CH3_g
91	3.5d-3.6c	CH3HCH* + CH4_g <-> CH3HCH2-CH3* -> CH3HCH2* + CH3_g
92	3.5e-3.6c	H2C2H3* + CH4_g <-> C2H6-CH3* -> CH3HCH2* +CH3_g
93	3.5e-3.6a	H2C2H3* + CH4_g <-> CHCH5-CH3* -> H2C2H4* + CH3_g
94	3.5f-3.6d	C2H3H2* + CH4_g <-> CH2CH4-CH3* -> C2H3H3* + CH3_g
95	3.5f-3.6b	C2H3H2* + CH4_g <-> CH3CH3-CH3* -> C2H4H2* + CH3_g
96	3.5h-3.6e	H2CCH3* + CH4_g <-> CH4CH2-CH3* -> H2CCH3H* + CH3_g
97	3.5h-3.7c	H2CCH3* + H2_g <-> C2H5-H2* -> H2CCH3H2*
98	3.5i-3.6b	H2CCH2H* + CH4_g <-> CH5CH-CH3* -> C2H4H2* + CH3_g
99	3.5i-3.6e	H2CCH2H* + CH4_g <-> CH6C-CH3* -> H2CCH3H* + CH3_g
100	3.6a-3.7b	H2C2H4* + CH4_g <-> CH3-CH3H2CH2* -> CH3H2CH2* + CH3_g
101	3.6b-3.7c	C2H4H2* + CH4_g <-> C2H7-CH3* -> H2CCH3H2* + CH3_g
102	3.6b-3.7a	C2H4H2* + CH4_g <-> C2H4H3-CH3* -> C2H4H3* + CH3_g
103	3.6c-3.7b	CH3HCH2* + CH4_g <-> CH3H2CH2-CH3* -> CH3H2CH2* + CH3_g
104	3.6d-3.7a	C2H3H3* + CH4_g <-> CH3-C2H4H3* -> C2H4H3* + CH3_g
105	3.6e-3.7c	H2CCH3H* + CH4_g <-> CH6CH-CH3* -> H2CCH3H2* + CH3_g
106	3.7a-3.8a	C2H4H3* + CH4_g <-> CH3-C2H5H3* -> C2H5H3* + CH3_g
107	3.7b-3.8b	CH3H2CH2* + CH4_g <-> CH3H2CH3-CH3* -> CH3H2CH3* + CH3_g
108	3.7c-3.8a	H2CCH3H2* + CH4_g <-> C2H8-CH3* -> C2H5H3* + CH3_g